

5 | IMPLEMENTATION OF THE PERMANENT X-FACTOR

Sharing versus Moving Average

The fundamental importance of the goals underlying sharing is unchanged, and some means for assuring their fulfillment should be incorporated into any long-term price caps mechanism.

The requirement that price cap LECs “share” with ratepayers earnings in excess of some benchmark level has been a long-established feature of price cap plans at both the state and federal levels. At the same time, LECs have sought to eliminate the sharing requirement, claiming that it diminishes their economic incentives to operate efficiently and thereby to increase earnings overall.¹⁶⁵ In its First Report and Order in this proceeding, the Commission modified the prior sharing formula by introducing three alternative levels of the X-factor, each of which was paired with a specific sharing obligation. In the Fourth Further Notice, the Commission seeks comment on the merits of this arrangement and on its continuation or modification in the context of a “permanent” price cap formula. In this section, we review the purposes of sharing as they were originally posited in early price cap plans (including the one adopted by the FCC in 1990), and consider the appropriateness of modifying the sharing requirements in light of the continuing need to maintain these original goals.

165. Similar arguments have been advanced with respect to corporate income taxes which, in essence, require businesses to “share” a portion of their earnings with the government. The presence and persistence of such taxes has not chilled entrepreneurial activity; indeed, in opposing the ongoing sharing obligation none of the LECs have suggested that the sharing implied by the presence of corporate income taxes must also be eliminated lest they lose their incentive to operate efficiently.

Purposes of sharing

Reduced to its simplest form, there are essentially two principal purposes for including a sharing requirement in a price cap plan:

1. To provide an "automatic stabilizer" to protect ratepayers of monopoly LEC services against pricing excesses that may be attributable to misspecification of the price cap index formula itself.
2. To provide a device for assuring that, to the extent that incentive regulation actually has a salutary impact upon LEC efficiency, consumers of monopoly LEC services are afforded the opportunity to benefit directly from this new form of regulation.

In the original LEC Price Caps decision and more recently in the First Report and Order, the Commission further expanded the role of sharing to include a device for permitting the concurrent application of multiple X-factors, with each LEC afforded the opportunity to make voluntary choices among several alternative X-factor levels by either accepting or avoiding specific sharing requirements. Essentially, the Commission utilized this device to encourage each LEC to accept the highest X-factor consistent with its own unique operational circumstances. As we shall demonstrate, this use of the sharing device, while perhaps accomplishing this recently-added goal of offering LECs a choice of X-factor, actually has the effect of undermining the original purposes of sharing.

The fundamental importance of these two basic goals is unchanged, and some means for assuring their fulfillment should be incorporated into any permanent price caps mechanism. Sharing may be that device, or some alternative approach may be found to be as — or even more — effective. But whatever device is ultimately adopted, the result must be to protect consumers against misspecification of the price cap formula parameters (principally the X-factor), assurance that consumers benefit directly from incentive regulation, and encouragement as to the selection of the highest possible X-factor by each incumbent, dominant LEC.

Misspecification of the price cap formula

In this report, we have discussed the significant misspecification of the basic price cap formula that has occurred both in the initial LEC Price Cap order and in the First Report and Order in this review proceeding. Specifically, we noted that

- The productivity offset (X) factor was incorrectly based upon a seriously flawed estimate of Total Factor Productivity that, among other things, failed to fully and accurately

ly reflect the consistent and substantial decreases in the real quality-adjusted prices of LEC inputs that have occurred since the 1984 divestiture of the former Bell System.

- The Total Factor Productivity (TFP) and resulting X-factor were based upon total company, rather than interstate-only, LEC operations, resulting in an understatement of output growth rates and hence an understatement of interstate TFP
- The USTA productivity study itself upon which the Commission relied in its First Report and Order was developed from undocumented and unreliable LEC data, about which little if anything is known as to its sources and manner of compilation, and as such is neither replicable nor verifiable.
- The USTA productivity study failed to recognize the distinction between debt and equity in the application of taxes as part of the rental price formula;
- The USTA productivity study applied inappropriate depreciation rates based upon business assets economywide over the pre-divestiture period, rather than using depreciation rates which correctly reflect the fundamental economic conditions of capital recovery for the LECs; and
- The USTA productivity study derived output quantities using a deflated revenue approach which relies on seemingly flawed output price indices, instead of output measures based upon direct physical quantities.

There is substantial empirical basis to conclude that the X-factor has, up to now, been seriously misspecified. The LECs have experienced persistent growth in interstate earnings of roughly 4% per year since the onset of price caps in 1991,¹⁶⁶ despite price cap real rate reductions and such competition as has developed.

The need for a mechanism to account for such consistent misspecification and, in particular, understatement of the offset factor is not diminished with time or with the modest increases in competition that has arisen in a few isolated market niches. Sharing and low-end adjustments protect both ratepayers and LECs against misspecification in both directions. However, the combined operation of these two mechanisms is far from symmetric. LEC management has available to it a number of specific devices that can alter reported earnings. For example, by increasing depreciation rates and other accruals, LECs can reduce the level of reported earnings that might be subject to sharing or, for that matter, that could decrease to a point where the low-end adjustment mechanism might become operational. LECs can affect reported earnings by advancing or deferring capital expenditures

166. Calculation based on FCC Form 492A, 1991-1994.

among accounting periods. LECs can affect reported earnings by reducing prices for certain services subject to competition, thereby financing potentially anticompetitive pricing behavior by the sharing mechanism itself.

Such practices would be difficult to detect or to correct even under rate of return regulation; they are virtually impossible to address under price caps. For these reasons, it must be presumed that LECs' reported earnings have the potential to be, or in fact are, systematically biased in the downward direction. If LEC earnings fall to a point where the low-end adjustment threshold is crossed, the LEC has the opportunity to initiate remedial action, including emergency rate increases and even a temporary return to RORR.¹⁶⁷ Nothing in the price cap mechanism (other than sharing and the capping of LEC earnings) imposes any duty on the part of LECs to *reduce* symmetrically rates if earnings grow to excessive levels. LECs have an incentive to convince this Commission to adopt the smallest possible X-factor which, coupled with the elimination of any sharing obligation, would assure excessive and sustained earnings.¹⁶⁸

The retention of a sharing requirement is thus integrally related to the Commission's approach to specifying the X-factor and other relevant parameters of the price cap mechanism. If the Commission errs on the side of a lower X-factor, then sharing and earnings caps become far more important than if the X-factor is set at the high end of a reasonable range. To the extent that the known infirmities in the existing price cap formula are eliminated and the X-factor is commensurately increased above its present, inadequate level, the need for sharing as a means for addressing potential misspecification is reduced.

Consumer participation in efficiency gains

One of the original goals of incentive regulation was the encouragement of increased efficiency on the part of the regulated firm. Rate of return regulation, it is held, fails to reward — and sometimes even penalizes — efficiency gains on the part of a utility's management, thereby discouraging efforts to improve efficiency. By at least partially delinking rates from underlying costs, price cap and other forms of incentive regulation

167. Even if the low-end adjustment mechanism were to be eliminated, LECs can still seek regulatory relief in the event of a sustained earnings shortfall. In California, where price cap regulation has been in place for Pacific Bell and GTE-California since January 1, 1990, both LECs are currently seeking precisely this kind of "bail-out" in both the current price cap review investigation (I.95-05-047) and in the Commission's local competition rulemaking (I.95-04-044), *even though neither of these two companies has come remotely close to crossing the low-end adjustment threshold.* See footnote 148, *infra*.

168. As we have shown, the USTA/Christensen TFP study and the inconsistent use of post-1984 and long term input price growth confirm that LECs are in fact affirmatively pursuing the goal of portraying their TFP and the resulting X-factor at the lowest possible level.

encourage utility management to pursue efficiency initiatives by permitting the company to retain some or all of the financial gains arising therefrom.

But incentive regulation also shifts certain risks to ratepayers, particularly where, as in the FCC's price cap plans, the price cap LECs are permitted to adjust prices for individual services by amounts that exceed the aggregate price cap adjustment level. For example, specific LEC services that do not confront effective, price constraining competition could be increased by as much as 5% annually in excess of the overall price cap increase. Over the five-year period from 1991 through the end of 1995, it is possible that individual rates could have been increased by as much as 25% over their pre-price caps levels.¹⁶⁹ Indeed, in the Second Further Notice issued in the present proceeding, the Commission is proposing to further increase the degree of flexibility with which individual rates can be adjusted. Consumers of services that do not currently confront effective price-constraining competition would be subject to disproportionately large future rate adjustments if certain of the tentative conclusions in the *Second Further Notice* were to be adopted.¹⁷⁰

It is thus entirely reasonable and necessary that the Commission incorporate specific mechanisms into the overall price cap system to assure that at least some portion of the efficiency gains expressly attributable to incentive regulation will be flowed through to ratepayers. In fact, the Commission recognized this requirement in the initial LEC Price Cap Order by incorporating into the price cap adjustment mechanism the so-called "Consumer Productivity Dividend" (CPD) of an additional 0.5% per year over and above the then-adopted estimate of long term LEC productivity.¹⁷¹

There is a direct interaction between the CPD and the sharing mechanism. The CPD is a sort of "advance payment" on the sharing obligation that is to be distributed to ratepayers irrespective of realized earnings levels, as compensation for ratepayer acceptance of incentive regulation. There is a direct relationship between the amount of the CPD and the "dead band" within which no sharing is required. In the LEC Price Cap order, the Commission adopted a 50 basis point CPD and a 100 basis point dead band. It also adopted an alternative sharing requirement in which LECs could elect to accept a one percentage point increase in the X-factor (in effect, a one percentage point increase in the CPD) in exchange for a larger, 200-basis point sharing dead band. In the First Report and Order in this review proceeding, the Commission offered three alternative X-factors to the LECs with successively more liberal sharing policies, including one in which all sharing and earnings caps are eliminated altogether.

169. *LEC Price Cap Order*, para. 224.

170. See Comments of the Ad Hoc Committee responding to the *Second Further Notice*, filed May 11, 1995.

171. *LEC Price Cap Order*, para. 100.

Whether or not LECs should be offered such elections is a separate question that we will address shortly. For the present, we emphasize that the long-standing recognition of the inverse relationship between the X-factor and the degree of sharing must continue to be observed. Increasing the CPD is an alternative to sharing, because like sharing it accomplishes the goal of transferring to ratepayers a portion of the increased efficiency attributable to incentive regulation. Indeed, the only difference between the two, from the consumers' standpoint, is whether it is to apply as an absolute matter or in relation to the realized operational results experienced by the LEC. *A priori*, and assuming that the relationship is correctly established (a major assumption that may be difficult to realize), consumers should be largely indifferent as between the *ex ante* CPD or the *ex post* sharing arrangement.

The *ex ante* CPD offers several benefits that address some of the specific concerns about sharing that have been expressed both by LECs and by the Commission. If the consumer payment is made up front, the LEC no longer confronts any attenuation of its efficiency incentives under a sharing requirement. That is, having made the up-front CPD flow-through, the LEC is then enabled to retain 100% of all increases in realized earnings within the zone of reasonableness. Increasing the up-front CPD component also overcomes the LECs' incentive to understate realized earnings, since there would be no direct financial consequence of reporting higher earnings, as would occur under a sharing regime.

However, if the Commission elects to eliminate sharing for these reasons, it is essential that consumers be made economically indifferent to that decision. This would be accomplished by increasing the CPD to a level that is equal to the expected level of sharing (including the effects of any earnings cap) that consumers would otherwise experience under the *ex post* approach. The problem, of course, is that this may be difficult to do in practice.

Choice of X-factors and sharing levels

The third application of sharing that has now been employed by the Commission in both the LEC Price Cap Order and in the First Report and Order in this proceeding was for the purpose of encouraging LECs to select the highest X-factor consistent with their respective earnings expectations. Thus, LECs that anticipated increased earnings (due, perhaps, to higher-than-average productivity growth, a high rate of demand growth, or other conditions unique to the particular LEC) would be encouraged to elect the highest of the three X-factors (5.3%) and thereby escape all sharing and earnings cap constraints. On the other hand, LECs whose productivity growth rate is below average would be offered the ability to elect a relatively low X-factor (4.0%), but would then become subject to substantial sharing obligations and earnings limits.

While this "election" approach may be effective in classifying individual LECs with respect to their respective productivity expectations, it effectively vitiates the sharing requirement. LECs that anticipate above-average performance and productivity growth will elect the highest X-factor, but will thereby escape any further sharing obligation. LECs with low productivity and earnings expectations will elect the lowest X-factor but, since they are by definition those with low earnings results, they will not be required to share anything as a practical matter despite the nominal obligation to do so under the low X-factor election that they may have made. Indeed, as formulated in the First Report and Order, the only condition under which any sharing will realistically take place is where the LEC has erred in its own earnings forecast, and then only with respect to those LECs that had forecast low earnings to begin with.

Table 6
EXPECTED INTERSTATE RATE OF RETURN
UNDER THE FCC PRICE CAP OPTIONS
(Example for Pacific Bell)

4% Option		4.7% Option		5.3% Option
<u>Before Sharing</u>	<u>After Sharing</u>	<u>Before Sharing</u>	<u>After Sharing</u>	<u>No Sharing</u>
12.00	12.00	11.70	11.70	11.45
12.25	12.25	11.95	11.95	11.70
12.75	12.50	12.45	12.35	12.20
13.05	12.65	12.75	12.50	12.50
13.25	12.75	12.95	12.60	12.70
13.75	12.75	13.45	12.85	13.20
14.25	12.75	13.95	13.10	13.70
14.75	12.75	14.45	13.35	14.20
15.25	12.75	14.95	13.60	14.70
15.75	12.75	15.45	13.85	15.20
16.25	12.75	15.95	14.10	15.70
16.75	12.75	16.45	14.25	16.20
17.00	12.75	16.70	14.25	16.45

In fact, the LEC will be confronted with an unambiguous choice of X-factor based upon its projected level of interstate earnings, as summarized in the following table calculated on the basis of Pacific Bell's interstate revenues and rate base as a example. As shown in Table 6 below, for earnings levels below 13.25%, the correct choice is the 4.0% X-factor (which would permit Pacific to earn 12.75% after sharing); for earnings levels in excess of this amount, the correct choice is the 5.3% option. As it turns out, there is no level of earnings at which the 4.7% choice that was offered to the LECs in the *First Report and Order* would be selected. Significantly, assuming that the correct election is made and that earnings levels have been correctly forecast, no sharing will take place under any of the three X-factor alternatives offered by the Commission in the current price cap system.

In fact, all that the present system does is to encourage LECs to engage in "gaming" of the regulatory system itself. Because elections are to be made on an annual basis, it is a relatively simple matter for the LEC to both forecast its earnings levels and to take remedial

accounting steps during the course of the one-year period to ensure that its choice is borne out. For example, it would be entirely possible for a LEC to deliberately select the 4.0%, maximum sharing alternative in a year in which it undertakes significant capital spending and plant retirements, then elect the 5.3%, no-sharing choice for the subsequent year, during which such spending and retirements can be deferred. By flipping between the no-sharing/maximum-sharing choices, the LEC can achieve consistent excess earnings over successive two-year periods while never having to share any of those excess earnings with ratepayers.

To a significant extent, the presence of a range of X-factor options also contravenes the foundational price cap goal of de-linking rates from costs. As initially envisioned, the X-factor was to represent some sort of "standard" or "target" benchmark. LECs that outperformed the benchmark would be rewarded; those falling short of it would be punished. By offering low-performance LECs the opportunity to select and operate under a lower-than-average X-factor, that "punishment" is substantially diminished.

A moving average that does not realistically reflect technical diffusion as would be characterized in a competitive market environment does not provide an effective substitute for sharing.

USTA has proposed, in lieu of a sharing mechanism, that the X-factor be revised on an annual basis to reflect changes in the LEC TFP growth rate that may occur from time to time. The salient features of the USTA plan can be summarized as follows:

- The X-factor would be subject to an annual adjustment based upon a five-year moving average LEC TFP with a two-year lag. Thus, the X factor that would become applicable in 1995 would be based upon the average LEC TFP calculated for the period 1988-1992, the X Factor that would become applicable in 1996 would be based upon the average LEC TFP calculated for the period 1989-1993, etc.¹⁷²
- The X-factor itself would be set equal to the *differential* between the moving average LEC TFP and the moving average economy-wide TFP calculated over the same five-year period with a two-year lag.
- Initially, LECs electing to adopt the USTA plan would be required to reduce their price cap index (PCI) for the year of the election by 1%. Subsequent annual changes in the PCI would use the election-year PCI as a base. No other reinitial-

172. "A USTA Proposal for the LEC Price Cap Plan", FCC CC Docket No. 94-1, January 18, 1995, "USTA January 1995 Proposal", Attachment 1, at page 1, note 1.

ization of rates would be required.

- Sharing would be totally eliminated. However, in the initial year in which the USTA option is offered, the Consumer Productivity Dividend (CPD) would be increased to 1%, would be set at 0.5% in the second year, 0.25% in the third year, and be phased out altogether thereafter. Note that the CPD phase-out runs from the adoption of the USTA plan by the FCC, not from the date of its election by any individual LEC. LECs would be permitted to elect the USTA plan at any time following the date of its adoption by the Commission, and would be subject to the then-existing CPD. Once elected, reversion to the current plan would not be permitted.

In advancing this proposal, USTA concedes that, in competitive markets, productivity gains achieved by individual firms are ultimately flowed through to consumers. In competitive markets, when one firm initiates the use of a new production technique or technology that results in reduced costs and/or in product improvements, its rivals will ultimately mimic that initiative and in so doing bid down prices to reflect the new cost conditions. Indeed, in competitive markets, firms that are not able to mimic their more efficient rivals will be forced out of the market altogether.

While LECs often complain that under rate of return regulation they are forced to "give back" their efficiency gains in the form of rate reductions, this outcome is in actuality not unlike the conditions that prevail in competitive markets. Indeed, to the extent that price cap regulation may permit LECs to *retain* the benefits of productivity improvements for an extended period of time (for example, if there is no sharing requirement), it is possible that price cap regulation may produce results that are even more removed from the "competitive outcome" objective of economic regulation than has traditionally occurred under RORR.

Of course, while the *theory* of competitive market behavior holds that productivity gains are eventually flowed through to consumers, it provides little direct guidance as to precisely how quickly this will occur. In some cases, innovations may be retained for extended periods of time. For example, if the new technique is covered by one or more patents, the competitive advantage can persist for the life of the patent. Pharmaceutical companies, for example, have been able to retain proprietary rights over new drugs until the governing patents run out. When a number of firms both possess essentially similar technologies and, more importantly, are actively engaged in research, development, and innovation of their own, gains achieved by one firm may be short-lived indeed. In technologically volatile industries such as computers and telecommunications equipment, productivity gains can be exploited for very short periods of time (perhaps on the order of months), because any of a number of firms can readily replicate the new technique, product design, or other

innovation to which the competitive marketplace has been subjected.¹⁷³

USTA is proposing that the X-factor be revised annually based upon a five-year moving average of the LEC TFP (calculated using the Christensen methodology) and that the result be lagged by an additional two years. Thus, the X-factor applicable for the July, 1996 price cap adjustment date would, under this schedule, be based upon the average LEC TFP for the period 1989-93. Put another way, any productivity improvement that occurred in 1995 would not be fully captured in the X-factor until the year 2002. USTA has offered no credible basis for this protracted period of diffusion, nor could it, because USTA's plan does not come remotely close to mirroring the behavior of competitive, technology-impacted markets.

Under the USTA moving average TFP proposal, shareholders, rather than customers, are permitted to capture and retain most of the productivity gains that the price cap LECs will enjoy. The USTA proposal is thus not a substitute for sharing or for a CPD, and must be rejected.

A moving average based upon a misspecified X-factor does not provide an effective substitute for sharing.

Even if there were merit in the five-year moving average TFP approach that USTA has advanced (which, as we have shown, there is not), one of the basic premises upon which the USTA plan is predicated is demonstrably false. USTA contends that the annual TFP recalculation process will be straightforward and uncontroversial because "[m]ost of the data are either taken directly from public sources or derived from them."¹⁷⁴ As we have shown, and as Dr. Christensen's testimony in California has confirmed, USTA's characterizations of the computational methods and data sources are anything but simple and straightforward. As discussed in Section 2 of this report, the data underlying the Christensen TFP model are not taken from public sources, but are instead derived from internal LEC data much of which is claimed to be proprietary. The full methodology is not documented, in that extensive data analysis and data reduction occurred within the individual USTA member companies the details of which were not even known to Dr. Christensen.

173. Although a difficult area to test empirically, research on the relationship of market structure to innovative activity and technology diffusion suggests that an increasingly competitive telecommunications market will hasten the rate of both phenomena. See, e.g., P. A. Geroski, "Innovation, Technological Opportunity, and Market Structure," *Oxford Economic Papers*, Vol. 42, (1990), pp. 586-602.; Romeo, A. A., "The Rate of Imitation of a Capital-Embodied Process Innovation," *Economica*, Vol. 44, (1977), pp. 63-69.; Edwin Mansfield, "Technical Change and the Rate of Imitation," *Econometrica*, Vol. 29, No. 4, (October 1961).

174. USTA January 18, 1995 *ex parte*, Attachment 1, p. 2. Emphasis supplied.

Implementation of the Permanent X-factor

The data and methodological deficiencies we have identified herein make the Christensen TFP study and study process not useful even for purposes of calculating a single TFP subject to examination in a contested rulemaking proceeding; it could not therefore even remotely be considered acceptable for a “mechanical” annual updating process such as envisioned under USTA’s proposal.

Appendix A

ECONOMIC DEPRECIATION RATES: BUSINESS ASSETS

Source: D.W. Jorgenson, "Productivity and Economic Growth," in *Fifty Years of Economic Measurement*, (E.R. Berndt and J.E. Triplett, eds., 1990), Table 3.6., page 45. (Jorgenson).

Table 3.6 Economic Depreciation Rates: Business Assets

Assets	Old Lifetime	Old Depreciation Rate	New Lifetime	New Depreciation Rate
1. Household furniture & fixtures	15	.1100	12	.1375
2. Other furniture	15	.1100	14	.1179
3. Fabricated metal products	18	.0917	18	.0917
4. Steam engines & turbines	21	.0786	32	.0516
5. Internal combustion engines	21	.0786	8	.2063
6. Farm tractors	8	.1633	9	.1452
7. Construction tractors	8	.1633	8	.1633
8. Agricultural machinery	17	.0971	14	.1179
9. Construction machinery	9	.1722	10	.1722
10. Mining & oilfield machinery	10	.1650	11	.1500
11. Metalworking machinery	16	.1225	16	.1225
12. Special industry machinery	16	.1031	16	.1031
13. General industrial	14	.1225	16	.1225
14. Office, computing	8	.2729	8	.2729
15. Service industry machinery	10	.1650	10	.1650
16. Communication equipment	14	.1179	15	.1100
17. Electrical transmission	14	.1179	33	.0500
18. Household appliances	14	.1179	10	.1651
19. Other electrical equipment	14	.1179	9	.1834
20. Trucks, buses, & truck trailers	9	.2537	9	.2537
21. Autos	10	.3333	10	.3333
22. Aircraft	16	.1833	16	.1833
23. Ships & boats	22	.0750	27	.0611
24. Railroad equipment	25	.0660	30	.0550
25. Scientific & engineering instruments	11	.1473	12	.1350
26. Photocopy & related equipment	11	.1473	9	.1800
27. Other nonresidential equipment	11	.1473	11	.1473
28. Industrial buildings	27	.0361	31	.0361
29. Mobile offices	36	.0247	16	.0556
30. Office buildings	36	.0247	36	.0247
31. Commercial warehouses	36	.0247	40	.0222
32. Other commercial buildings	36	.0247	34	.0262
33. Religious buildings	48	.0188	48	.0188
34. Educational buildings	48	.0188	48	.0188
35. Hospital & institutional buildings	48	.0233	48	.0233
36. Hotels & motels	40	.0247	32	.0247
37. Amusement & recreational	31	.0454	30	.0469
38. Other nonfarm buildings	31	.0454	38	.0370
39. Railroad structures	51	.0176	54	.0166
40. Telephone & telegraph structures	27	.0333	40	.0225
41. Electric light & power structures	30	.0300	40	.0225
42. Gas structures	30	.0300	40	.0225
43. Local transit	26	.0450	38	.0450
44. Petroleum pipelines	26	.0450	40	.0450
45. Farm structures	38	.0237	38	.0237
46. Petroleum & natural gas	16	.0563	16	.0563
47. Other mining exploration	16	.0563	16	.0563
48. Other nonresidential structures	31	.0290	40	.0225
49. Railroad replacement track	51	.0176	38	.0236
50. Nuclear fuel	—	—	6	.2500
51. Residential structures	—	.0130	—	.0130

Source: Jorgenson and Yun (1990), table 13B, p. 82.

Appendix B COMPARISON OF TPIS USED IN THE CHRISTENSEN STUDY WITH BEA/BLS ASSET DEFLATORS

Table B1	Mapping of TPIS and BEA/BLS Asset Deflators
Table B2	Derivation of BEA/BLS-based Asset Deflator for Christensen General Support Category
Table B3	Restatement of Original BLS Data to 1984 Base Year

Table B1
Mapping of TPIs and BEA / BLS Asset Deflators

Year	Christensen		BEA / BLS	
	General Support		Weighted Average of Other Nonresidential Equip., Autos, Computers, Aircraft & Buildings ¹	
	TPI	% Change	Asset Deflator Index	% Change
1984	1.000		1.000	
1985	0.993	-0.7%	0.920	-8.3%
1986	0.974	-1.9%	0.879	-4.6%
1987	0.987	1.3%	0.858	-2.4%
1988	1.013	2.6%	0.844	-1.7%
1989	1.003	-1.0%	0.887	5.0%
1990	0.988	-1.5%	0.884	-0.3%
1991	0.905	-8.8%	0.868	-1.8%
1992	0.843	-7.1%	0.849	-2.2%
1993	0.803	-4.9%	0.855	0.6%

Year	Christensen		BEA / BLS	
	Central Office		Communications Equipment ² (PA16)	
	TPI	% Change	Asset Deflator Index	% Change
1984	1.000		1.000	
1985	0.995	-0.5%	1.022	2.1%
1986	0.972	-2.3%	1.048	2.5%
1987	0.981	0.9%	1.081	3.1%
1988	0.964	-1.7%	1.111	2.8%
1989	0.965	0.1%	1.091	-1.9%
1990	0.967	0.2%	1.103	1.1%
1991	0.955	-1.2%	1.117	1.3%
1992	0.927	-3.0%	1.130	1.2%
1993	0.955	3.0%	1.147	1.5%

Year	Christensen		BEA / BLS	
	Transmission		Communications Equipment ² (PA16)	
	TPI	% Change	Asset Deflator Index	% Change
1984	1.000		1.000	
1985	1.048	4.7%	1.022	2.1%
1986	1.066	1.7%	1.048	2.5%
1987	1.074	0.7%	1.081	3.1%
1988	1.036	-3.6%	1.111	2.8%
1989	1.053	1.6%	1.091	-1.9%
1990	1.064	1.0%	1.103	1.1%
1991	1.080	1.5%	1.117	1.3%
1992	1.074	-0.6%	1.130	1.2%
1993	1.097	2.1%	1.147	1.5%

Year	Christensen		BEA / BLS	
	Information Orig./Term.		Communications Equipment ² (PA16)	
	TPI	% Change	Asset Deflator Index	% Change
1984	1.000		1.000	
1985	1.041	4.0%	1.022	2.1%
1986	1.072	2.9%	1.048	2.5%
1987	1.054	-1.7%	1.081	3.1%
1988	1.074	1.9%	1.111	2.8%
1989	1.096	2.0%	1.091	-1.9%
1990	1.105	0.8%	1.103	1.1%
1991	1.103	-0.2%	1.117	1.3%
1992	1.094	-0.8%	1.130	1.2%
1993	1.122	2.5%	1.147	1.5%

Year	Christensen		BEA / BLS	
	Cable and Wire		Telecommunications Structures ² (PA40)	
	TPI	% Change	Asset Deflator Index	% Change
1984	1.000		1.000	
1985	1.012	1.2%	1.020	2.0%
1986	1.014	0.2%	1.010	-1.0%
1987	1.020	0.6%	1.010	0.0%
1988	1.070	4.8%	1.020	1.0%
1989	1.134	5.8%	1.111	8.5%
1990	1.138	0.4%	1.141	2.7%
1991	1.155	1.5%	1.152	0.9%
1992	1.145	-0.9%	1.152	0.0%
1993	1.145	0.0%	1.195	3.7%

Year	Christensen		BEA / BLS	
	Buildings		Telecommunications Structures ² (PA40)	
	TPI	% Change	Asset Deflator Index	% Change
1984	1.000		1.000	
1985	1.028	2.8%	1.020	2.0%
1986	1.054	2.5%	1.010	-1.0%
1987	1.078	2.1%	1.010	0.0%
1988	1.115	3.6%	1.020	1.0%
1989	1.139	2.1%	1.111	8.5%
1990	1.179	3.5%	1.141	2.7%
1991	1.211	2.7%	1.152	0.9%
1992	1.241	2.4%	1.152	0.0%
1993	1.287	3.6%	1.195	3.7%

Notes:

- (1) See Appendix 3 at p 2 for Derivation of Asset Deflator Index.
(2) All BLS Data is restated to 1984 as a Base Year. See Appendix 3, at p 3.

Sources:

- (1) Christensen Data: Productivity of the Local Operating Telephone Companies Subject to Price Cap Regulation - 1993 Update, Laurits R. Christensen, Philip E. Schoech and Mark E. Meitzen, Christensen Associates, January 18, 1995.
(2) BEA Asset Price Deflators, Unpublished BLS Data used for U.S. Department of Labor News Release, USDL 95-48, February 14, 1995. Data is restated to 1984 as base year. See Appendix 3 at pp 2,3.

Table B2

Derivation of BEA / BLS-based Asset Deflator for Christensen General Support Category

Step 1.

Costs of Assets Included in SOCC General Support Category
(Amounts Shown in Thousands)

SOCC Acct #	Account Title	Cost	Share of Total Cost
2111	Land	988,979	3.09%
2112	Motor Vehicles	1,844,265	5.76%
2113	Aircraft	49,512	0.15%
2114	Special Purpose Vehicles	3,159	0.01%
2115	Garage Work Equipment	99,554	0.31%
2116	Other Work Equipment	1,522,267	4.76%
2121	Buildings	16,308,417	50.94%
2122	Furniture	983,005	2.16%
2123	Office Equipment	1,778,600	5.56%
2124	General Computers	8,724,229	27.25%
2110	Total	32,011,987	100.00%

Step 3.

Original BEA / BLS Data and SOCC-based Cost Share Data Used for
Derivation of Asset Deflator Index for General Support Category

BEA Asset Categories Share of Total Cost	PA14	PA27	PA21	PA22	PA40
	0.273	0.106	0.058	0.002	0.562
1984	1.675	0.936	0.897	0.978	0.990
1985	1.276	0.961	0.926	0.972	1.010
1986	1.104	0.979	0.965	0.980	1.000
1987	1.000	1.000	1.000	1.000	1.000
1988	0.899	1.038	1.020	1.014	1.010
1989	0.880	1.074	1.040	1.074	1.100
1990	0.788	1.110	1.056	1.130	1.130
1991	0.682	1.136	1.093	1.196	1.140
1992	0.590	1.148	1.120	1.245	1.140
1993	0.510	1.168	1.148	1.274	1.183

Step 2.

Share of Costs of Different BEA / BLS Asset Categories with
Respect to Total Cost of SOCC General Support Category

BEA	SOCC	Account Title	Share of Total Cost
PA 14	2124	General Computers	27.25%
		Office, Computing and Accounting Machinery	27.25%
	2123	Office Equip	5.56%
	2115	Garage Work Equip	0.31%
PA 27	2116	Other Work Equip	4.76%
		Other Nonresidential Equip.	10.62%
	2112	Motor Vehicles	5.76%
PA 21	2114	Special Purpose Vehicles	0.01%
		Autos	5.77%
PA 22	2113	Aircraft	0.15%
		Aircraft	0.15%
PA 40	2111	Land	3.09%
	2121	Buildings	50.94%
	2122	Furniture	2.16%
		TeleStructures	56.20%
	2110	Total	100.00%

Step 4.

Derivation of Asset Deflator Index for General Support Category

Year	PA14 x Cost Share	PA27 x Cost Share	PA21 x Cost Share	PA22 x Cost Share	PA40 x Cost Share	Derived BLS-based Index	Index Restated to 1984 Base Year
1984	0.456	0.099	0.052	0.001	0.556	1.165	1.000
1985	0.348	0.102	0.053	0.001	0.568	1.072	0.920
1986	0.301	0.104	0.056	0.001	0.562	1.024	0.879
1987	0.273	0.106	0.058	0.002	0.562	1.000	0.858
1988	0.245	0.110	0.059	0.002	0.568	0.983	0.844
1989	0.240	0.114	0.060	0.002	0.618	1.034	0.887
1990	0.215	0.118	0.061	0.002	0.635	1.030	0.884
1991	0.186	0.121	0.063	0.002	0.641	1.012	0.868
1992	0.161	0.122	0.065	0.002	0.641	0.990	0.849
1993	0.139	0.124	0.066	0.002	0.665	0.996	0.855

Source:

(1) Statistics of Communications Common Carriers ("SOCC"),
Federal Communications Committee, July 7, 1995.(2) BEA Asset Price Deflators, Unpublished BLS Data used for
U.S. Department of Labor News Release, USDL 95-48, February 14, 1995

Table B3
Restatement of BLS Data to 1984 Base Year

Office, Computing and Accounting Machinery (PA14)		
Year	Original BLS Data	BLS Data Restated to 1984 Base Year
1984	1.675	1.000
1985	1.276	0.762
1986	1.104	0.659
1987	1.000	0.597
1988	0.899	0.537
1989	0.880	0.525
1990	0.788	0.470
1991	0.682	0.407
1992	0.590	0.352
1993	0.510	0.304

Communications Equipment (PA16)		
Year	Original BLS Data	BLS Data Restated to 1984 Base Year
1984	0.925	1.000
1985	0.945	1.022
1986	0.969	1.048
1987	1.000	1.081
1988	1.028	1.111
1989	1.009	1.091
1990	1.020	1.103
1991	1.033	1.117
1992	1.045	1.130
1993	1.061	1.147

Autos (PA21)		
Year	Original BLS Data	BLS Data Restated to 1984 Base Year
1984	0.897	1.000
1985	0.926	1.032
1986	0.965	1.076
1987	1.000	1.115
1988	1.020	1.137
1989	1.040	1.159
1990	1.056	1.177
1991	1.093	1.219
1992	1.120	1.249
1993	1.148	1.280

Aircraft (PA22)		
Year	Original BLS Data	BLS Data Restated to 1984 Base Year
1984	0.978	1.000
1985	0.972	0.994
1986	0.980	1.002
1987	1.000	1.022
1988	1.014	1.037
1989	1.074	1.098
1990	1.130	1.155
1991	1.196	1.223
1992	1.245	1.273
1993	1.274	1.303

Other Nonresidential Equipment (PA27)		
Year	Original BLS Data	BLS Data Restated to 1984 Base Year
1984	0.936	1.000
1985	0.961	1.027
1986	0.979	1.048
1987	1.000	1.068
1988	1.038	1.109
1989	1.074	1.147
1990	1.110	1.186
1991	1.136	1.214
1992	1.148	1.226
1993	1.168	1.248

Telecommunications Structures (PA40)		
Year	Original BLS Data	BLS Data Restated to 1984 Base Year
1984	0.990	1.000
1985	1.010	1.020
1986	1.000	1.010
1987	1.000	1.010
1988	1.010	1.020
1989	1.100	1.111
1990	1.130	1.141
1991	1.140	1.152
1992	1.140	1.152
1993	1.183	1.195



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